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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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S-456 S-456

August 1970

U.S. Training and
Employment Service
Technical Report
S-456

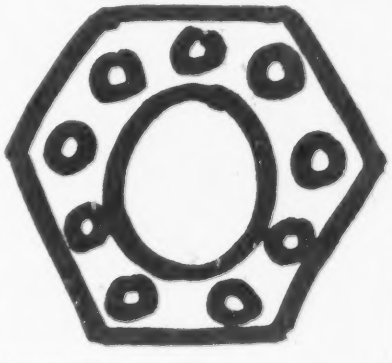
Development of USTES

APTITUDE TEST
BATTERY FOR

# ASSEMBLER, SMALL PRODUCTS

(any ind.)
739.887

U.S. DEPARTMENT OF LABOR
Manpower Administration



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ED 069643

# Technical Report on Development of USTES Aptitude Test Battery

for . . . .

Assembler, Small Products (any ind.) 739.887-034

(Developed in Cooperation with the
Wisconsin State Employment Service)

S-456

U. S. Department of Labor
Manpower Administration

August 1970

## FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB #2808

Development of USTES Aptitude Test Battery

For

Assembler, Small Products (any ind.) 739.887-034

S-456

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Assembler, Small Products (any ind.) 739.887. The following norms were established.

| GATB Aptitudes | Minimum Acceptable GATB Scores |
|---|---|
| Q - Clerical Aptitude | 85 |
| K - Motor Coordination | 85 |
| F - Finger Dexterity | 75 |
| M - Manual Dexterity | 90 |

RESEARCH SUMMARY

Sample:

60 female (59 nonminority and 1 American Indian) applicants who were later hired as Assembler, Small Products in Wisconsin.

Criterion:

Supervisory ratings.

Design:

Longitudinal (test data were collected before date of hire and criterion data after two months on the job).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations and selective efficiencies.

Predicted Validity:

Phi Coefficient = .80 ($P/2 < .0005$)

Effectiveness of Norms:

Only 73 percent of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 98 percent would have been good workers. 27 percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 2 percent would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

| | Without Tests | With Tests |
|---|---|---|
| Good Workers | 73% | 98% |
| Poor Workers | 27% | 2% |

SAMPLE DESCRIPTION

Size:

N = 60; 59 nonminority and 1 American Indian.

Work Setting:

Employed workers who had completed a training period. Workers were employed at Gale Products Company, Galesville, Wisconsin.

Employer Selection Requirements:

Education: None indicated.

Previous Experience: None indicated

Tests: None indicated.

Other: Personal interview.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the sample had at least two months' total job experience at the time of criterion collection.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, Experience and Cultural Exposure

| | Mean | SD | Range | r |
|---|---|---|---|---|
| Age (years) | 33.1 | 14.0 | 18-60 | -.298* |
| Education (years) | 10.9 | 1.6 | 8-13 | .390** |
| Experience (months) | 4.3 | 1.2 | 2-6 | -.152 |
| Cultural Exposure | 3.2 | 1.4 | 1-6 | .296* |

*Significant at the .05 level.
**Significant at the .01 level.

Experimental Test Battery

All 12 tests of the GATB, B-1002B, and the Research Questionnaire-Background were administered in September and December 1969.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made after the training period was completed. The immediate supervisor rated each worker.

Rating Scale:

A modified form of the SP-21 "Descriptive Rating Scale" for trainees was used. This scale (see Appendix) consists of eight items covering different aspects of training performance. Each item has five alternatives corresponding to different aspects of training proficiency.

Reliability:

A reliability coefficient of .83 was obtained between the initial ratings and the re-ratings, indicating a significant relationship. The final criterion score consisted of the combined scores for the two ratings.

Criterion Score Distribution:

| | |
|---|---|
| Possible Range: | 16-80 |
| Actual Range: | 28-79 |
| Mean: | 54.1 |
| Standard Deviation: | 8.4 |

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 27 percent of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated "good workers" and those in the low criterion group as "poor workers." The criterion critical score is 50.

## APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

| Aptitudes | Rationale |
|---|---|
| P - Form Perception | Required to inspect parts for defects and the completed unit for cleanliness. |
| K - Motor Coordination | Required to accurately and rapidly position parts to be assembled, attached and/or fastened. |
| F - Finger Dexterity | Required to manipulate small parts and hand tools. |
| M - Manual Dexterity | Required to handle parts to be assembled, positioned and moved; to actuate welding machine and heat press and to operate hand and portable power tools. |

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=60

| | Mean | SD | Range | r |
|---|---|---|---|---|
| G - General Learning Ability | 93.9 | 17.1 | 57-133 | .371** |
| V - Verbal Aptitude | 95.3 | 13.0 | 68-121 | .214 |
| N - Numerical Aptitude | 95.0 | 15.9 | 56-134 | .261* |
| S - Spatial Aptitude | 96.4 | 19.6 | 58-143 | .427** |
| P - Form Perception | 104.7 | 24.6 | 34-156 | .442** |
| Q - Clerical Perception | 110.4 | 14.6 | 70-142 | .407** |
| K - Motor Coordination | 105.0 | 15.1 | 64-153 | .379** |
| F - Finger Dexterity | 102.6 | 21.2 | 57-145 | .541** |
| M - Manual Dexterity | 104.1 | 19.9 | 57-147 | .473** |

* Significant at the .05 level.
** Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

| Type of Evidence | Aptitudes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | G | V | N | S | P | Q | K | F | M |
| Job Analysis Data | | | | | | | | | |
| Important | | | | | X | | X | X | X |
| Irrelevant | | | | | | | | | |
| Relatively High Mean | | | | | X | X | X | | X |
| Relatively Low Standard Dev. | | X | | | | X | | | |
| Significant Correlation with Criterion | X | | X | X | X | X | X | X | X |
| Aptitudes to be Considered for Trial Norms | G | | N | S | P | Q | K | F | M |

## DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, N, S, P, Q, K, F and M at trial cutting scores were able to differentiate between 73 percent of the sample considered to be good workers and 27 percent of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because they will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores slightly less than one-third below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Optimum differentiation for the occupation of Assembler, Small Products (any ind.) 739.887-034 was provided by the norms of Q-85, K-85, F-75 and M-90. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .80 (statistically significant at the .0005 level).

TABLE 6

Predictive Validity of Trial Norms
Q-85, K-85, F-75 and M-90

| | Nonqualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Workers | 3 | 41 | 44 |
| Poor Workers | 15 | 1 | 16 |
| Total | 18 | 42 | 60 |

Phi Coefficient = .80 Chi Square ($X^2_y$) = 38.2

Significance Level = P/2 < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-60 which is included in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A phi coefficient of .75 is obtained with the OAP-60 norms of Q-85, K-80, M-90.

APPENDIX

RATING TRAINEES

DESCRIPTIVE RATING SCALE

(For Aptitude Test Development Studies)

Score _____

RATING SCALE FOR _____
(DOT Title and Code for Training Course)

Directions: Please read "RATING TRAINEES - SUGGESTIONS TO RATERS" and then complete this rating scale. In making your ratings, only one box should be checked for each question.

Name of trainee (print) _____
(Last) (First)

Sex: Male _____ Female _____

A. How much aptitude or facility does he have for the vocational training? (Trainee's adeptness or knack for performing the work easily and well.)

☐ 1. Has great difficulty doing the work. Not at all suited for the training.

☐ 2. Usually has some difficulty doing the work. Not too well suited for the training.

☐ 3. Does the work without too much difficulty. Fairly well suited for the training.

☐ 4. Usually does the work without difficulty. Well suited for the training.

☐ 5. Does the work with great ease. Exceptionally well suited for the training.

B. How much ability does he have for maintaining adequate production in the vocational activity for which he was trained?

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

C. How good was the quality of his work during the vocational training?

☐ 1. Performance was inferior and almost never met minimum quality standards.

☐ 2. Performance was usually acceptable but somewhat inferior in quality. The grade of his work could stand improvement.

☐ 3. Performance was acceptable but usually not superior in quality.

☐ 4. Performance was usually superior in quality.

☐ 5. Performance was almost always of the highest quality.

D. How quickly did he learn the instructional units of the vocational training?

- ☐ 1. Learned the work very slowly. Needed careful and repeated instructions.
- ☐ 2. Learned the work somewhat slower than most.
- ☐ 3. Learned most of the work in the usual amount of time.
- ☐ 4. Learned most of the work quickly.
- ☐ 5. Learned all of the work very rapidly. Needed only the minimum amount of training or instructions for even the difficult aspects.

E. How much ability does he have for using the equipment of the vocational training?

- ☐ 1. Has very limited ability. Cannot use the equipment adequately.
- ☐ 2. Has little ability. Can use the equipment to "get by."
- ☐ 3. Has a moderate amount of ability. Can use the equipment to do fair work.
- ☐ 4. Has high ability. Can use the equipment to do good work.
- ☐ 5. Has very high ability. Can use the equipment to do excellent work.

F. How large a variety of job duties can he perform efficiently?

- ☐ 1. Cannot perform different operations adequately.
- ☐ 2. Can perform a limited number of different operations efficiently.
- ☐ 3. Can perform several different operations with reasonable efficiency.
- ☐ 4. Can perform many different operations efficiently.
- ☐ 5. Can perform an unusuallly large variety of different operations efficiently.

G. How resourceful is he in coping with work situations that are different or out of the ordinary?

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. Considering all the factors already rated, and only these factors, how acceptable was his performance during vocational training?

☐ 1. Performance was unsatisfactory.

☐ 2. Performance was not completely satisfactory.

☐ 3. Performance was satisfactory.

☐ 4. Performance was good.

☐ 5. Performance was outstanding.

August 1970

S-456

FACT SHEET

Job Title: Assembler, Small Products (any ind.) 739.887-034

Job Summary:

Assembles plastic, metal, glass, nylon and rubber parts of an illuminated cosmetic mirror, performing one or a combination of operations as a member of a progressive assembly line.

Work Performed:

Places two pieces of precut mirror, two pieces of styrofoam and two frame halves into a fixture according to instructions. Places fixture into previously set-up sonic welding machine. Actuates welding machine to perform weld at one junction of frame halves. Rotates fixture 180 degrees in welding machine and actuates machine to perform second weld to secure frame around mirror pieces. Removes fixture from machine. Removes subassembly from fixture and cleans mirror and frame. Positions two pieces of color coded diffuser parts into jig of spot welding machine. Actuates machine to weld parts together. Removes assembled diffuser from machine. Places pre-formed plastic from housing frame into previously set-up hot stamp machine. Actuates machine to stamp gold and silver lettering on housing frame. Removes frame from machine and inspects stamping for quality. Locates adhesive backed aluminum selector plate on front housing frame by means of a jig mounted in a heat press. Actuates press to adhere plate to housing frame. Removes frame from jig. Places adhesive backed aluminum decal on pre-formed plastic selector knob. Attaches one precut blue color coded wire into switch assembly by inserting one end of wire into pressure clip of switch. Positions two brackets and two bulb sockets on reflector shield by means of a jig. Spot welds brackets and sockets to shield. Removes subassembly from jig. Places two shield subassemblies into a spring loaded jig. Positions switch assembly into jig. Inserts one end of 3 different color coded precut wires into switch. Connects other end of wires to shield assembly. Removes assembly from jig and positions assembly into rear or bottom half of housing frame. Fastens reflector shields into housing frame by means of two screws. Positions two ballasts in housing frame and fastens ballasts into frame by driving three nuts onto hold down studs. Positions switch into frame and drives two screws to seat switch. Assembles and pulls pre-cut power cord into housing assembly. Makes two wire connections of cord to assembly circuit using crimp connectors. Places shield over connectors. Installs two bulbs. Tests bulbs and wiring assembly for continuity. Attaches plastic stand to rear housing frame using two rubber washers, washer screws and nylon stop. Installs selector knob in top of front housing frame. Snaps plastic molded rack into frame assembly. Installs two diffusers, pinbns and nylon pins into housing by snap type operation. Fastens front housing assembly to rear housing assembly with five screws. Assembles spring washer to mirror assembly. Installs mirror assembly into housing. Visually inspects and cleans assembled unit. Places U. L. label on housing after unit has had final test. Visually inspects unit and places unit into plastic bag. Places bagged unit into pre-formed styrofoam container. Places warranty and instruction sheet into container and places cover on container. Assembles precut cardboard box and places container into box. May work at individual work station or as a member of assembly group. May be assigned to different work situations as production needs require or shift from one station to another to reduce fatigue.

Effectiveness of Norms:

Only 73 percent of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with these norms, 98 percent would have been good workers. 27 percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with these norms, only 2 percent would have been poor workers.

Applicability of S-456 Norms:

The aptitude test battery is applicable to jobs which include a majority of the job duties described above.



GPO 899.075